FORTRAN PLOTTING SUBROUTINES FOR THE SPACE PLASMA LABORATORY

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ABSTRACT

The computer program outlined in this paper referred to as PLOTRW was custom made to satisfy some of the graphics requirements for the data collected in the Space Plasma Laboratory at the Johnson Space Center (JSC). The general requirements for the program were as follows:

(1) All subroutines shall be callable through a FORTRAN source program.

(2) All graphs shall fill one page and be properly labeled.

(3) There shall be options for linear axes and logarithmic axes.

(4) Each axis shall have tick marks equally spaced with numeric values printed at the beginning tick mark and at the last tick mark.

(5) There shall be three options for plotting. These are 1) point plot, 2) line plot and 3) point-line plot.

The subroutines were written in FORTRAN IV for the LSI-11 Digital equipment Corporation (DEC) Computer. The program is now operational and can be run on any TEKTRONIX graphics terminal that uses a DEC Real-Time-11 (RT-11) operating system.

INTRODUCTION

There are numerous plotting packages on the market today. Some of which are very general and comprehensive, while others are written for specific applications or tasks. Many of the comprehensive graphics packages require a great deal of computer memory for its operation and therfore operates more effectively in a main frame computer envirc:nment. But most small science

laboratories employ a microcomputer for their data reduction and data analysis. Thus, a comprehensive plotting package may not be very useful in a small laboratory environment.

Additionally, the specific application software packages very seldom if ever satisfy the many approaches a scientist might employ to study an experiment. For these reasons, among others, small laboratories strive to obtain custom made software that is compatible with their present computer system for their data reduction and data analysis.

THE RT-11 OPERATING SYSTEM

A computer system is the concerted efforts of the computer hardware and computer software working together to make it as easy as possible for a programmer to use the computer to solve problems and/or process data. The hardware elements are the mechanical devices in the system, the machinery and the electronics. While the software elements are the programs that are written to perform logical and mathematical operations and provides a means for you to control the system.

The LSI-11 computer employs an RT-11 operating system. the RT-11 is a disk based, single-user, real-time operating system designed for interactive program development. It offers optional support of a number of high-level language processors, including FORTRAN IV, BASIC, and APL.

A minimum RT-11 system must include the following: (1) a processor such as the LSI-11 processor, (2) at least 24K bytes of memory, (3) a console terminal, (4) a line frequency clock, (5) a system device (random access mass sotrage device, and (6) a system backup device.

SUMMARY - DOCUMENTATION PLOTRW

PLOTRW is written on a single side, single density flexible disck. The program consists of some three hundred and seventy two (372) lines of codes and twenty-one (21) subroutines. (See figure 1). Some of the subroutines are modifications from an existing plasma program at JSC, others are TEKTRONIX software and the remainder were developed by the writer.

PLOTRW is very easy to use. The hardware requirements include an RT-11 operating system, a DEC processor, a TEKTRONIX graphics terminal, and a TEKTRONIX printer. The program is started by typing on the terminal the string RUN PLOTRW followed by a carriage return. The following message will then be displayed (see figure 2):

IDATA = 1 INPUT DATA AT TERMINAL

IDATA = 2 INPUT DATA OTHER SOURCES

NDPTS = NO. OF DATA POINTS

IDATA? NDPTS?

The user should now enter a one or a two followed by a comma or blank, the number of data points and a carriage return. The string X? Y? is now written to the screen. The ordered pairs of real data points are now entered. Each ordered pair of points is followed by a carriage return. After all data points have been entered the screen will now display:

MODEP = 1 POINT PLOT

MODEP = 2 LINE PLOT

MODEP = 3 POINT-LINE PLOT

MODEP?

The number 1, 2 or 3 should now be entered followed by a carriage return to continue. The next message displayed on the screen gives options for plotting. The choices are linear-linear scales, log-linear, linear-log, and log-log.

It is not mandatory that all data in a data set be graphed. PLOTRW allows you to enter the number of data points you wish to be graphed. After entering this number and a carriage return another message is displayed on the screen. To continue enter any single digit integer and a carriage return.

The desired graph will now be displayed. A copy of the graph can be transferred to the printer. PLOTRW will make ten cycles with the same data set to allow the user options for changing graph requirements such as MODEP, MODE, etc. To initialize another cycle enter any single digit integer followed by a carriage return. To terminate the programs short of ten cycles, enter a control (CTRL) C.

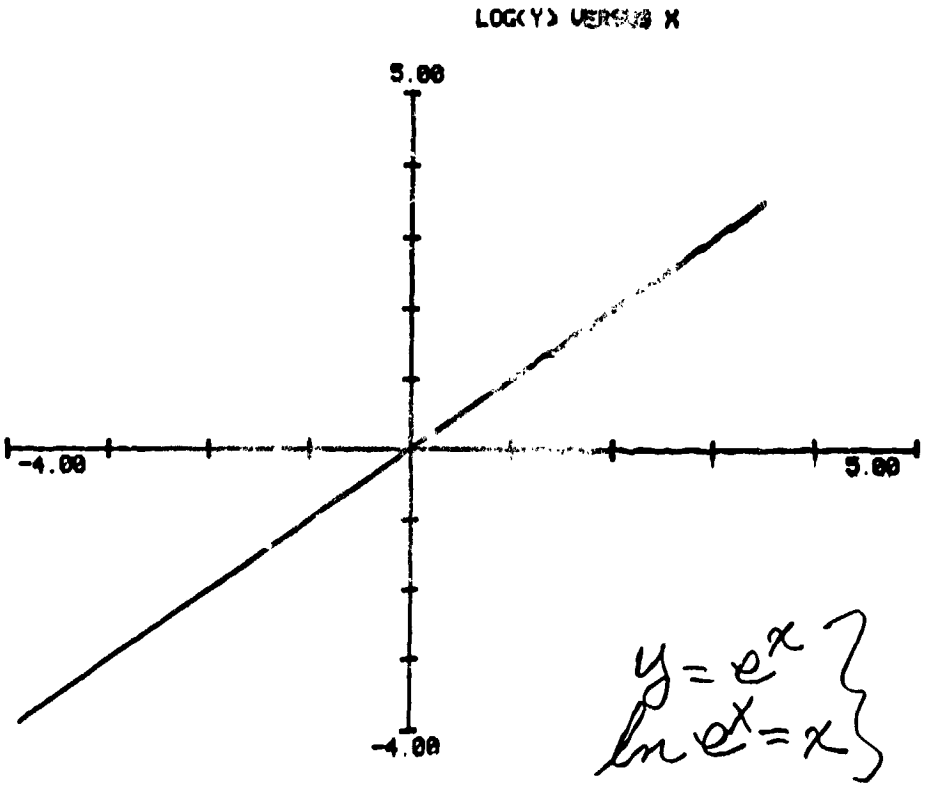
SUBROUTINES FOR PLOTRW

FIGURE 1

TERMINAL DISPLAY - PLOTRW INITIALIZATION CONSTANTS

```
RUN PLOTRW
IDATA=1 INPUT DATA AT TERMINAL
IDATA=2 DATA INPUT OTHER SOURCE(SEE SOURCE PROGRAM)

         NDPTS= NO  OF DATA POINTS

   IDATA?    NDPTS?
1,2
      X?          Y?
1.0,3.0
4.0,5.0
   MODEP=1 POINT PLOT
  MODEP=2 LINE PLOT
  MODEP=3 POINT-LINE PLOT

MODEP?
2
   MODE=1 Y VERSES X
   MODE=2 LOG(Y) VS X
   MODE=3 Y VS LOG(X)
   MODE=4 LOG(Y) VS LOG(X)

MODE?
4
   XUMIN=MIN VALUE X-AXIS    XUMAX=MAX VALUE X-AXIS
   YIMIN,YIMAX=MIN AND MAX VALUES Y-AXIS

   XUMIN?           XUMAX?
0.0,3.0
   YIMIN?,           YIMAX?
3.0,5.0
    NPTS=NO. OF DATA POINTS TO BE PLOTTED. NPTS SHOULD BE LESS THAN OR EQU
AL TO NO.DATA POINTS

   NPTS?
```

FIGURE 2



$y = e^x$
$\ln e^x = x$
$y = x$